3-D ELECTROMAGNETIC MODELING OF WAKEFIELDS IN ACCELERATOR COMPONENTS*

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ABSTRACT

We discuss the use of 3-D finite-difference time-domain (FDTD) electromagnetic codes for the modeling of accelerator components. Computational modeling of cylindrically symmetric structures such as induction accelerator cells has been extremely successful in predicting the wake potential and wake impedances of these structures, but fully 3-D modeling of complex structures has been limited due to the substantial computer resources required for a fully 3-D model. New massively parallel 3-D time domain electromagnetic codes now under development using conforming unstructured meshes allow a substantial increase in the geometric fidelity of the structures being modeled. Development of these new codes will be discussed in the context of their applicability to accelerator problems. A variety of 3-D structures are tested with an existing cubical cell FDTD code and the wake impedances are compared with simple analytic models for the structures. These results will provide a set of benchmarks for testing the new time domain codes. Structures under consideration include a stripline beam position monitor as well as circular and elliptical apertures in circular waveguides. Excellent agreement for the monopole and dipole impedances with the models are found for these structures below the cutoff frequency of the beam line.

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